Gelatin Packing of Intracortical Tract After Percutaneous Nephrostomy Lithotripsy for Decreasing Bleeding and Urine Leakage

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Background: Percutaneous nephrostomy is almost a daily routine procedure in clinical urologic practice. Tract bleeding and urine leakage along the percutaneous tract is a common event and bothersome to both patients and the surgeon. Herein we introduce a simple technique of gelatin packing for stopping subsequent bleeding and urine leakage immediately after a percutaneous nephrostomy lithotripsy (PCNL) procedure.

Methods: PCNL, using a tubeless technique, was performed in 15 patients with renal calculi. In all cases, stones were removed using grasping forceps after the stones were disintegrated with a lithoclast. In all patients, a retrograde internal ureteral stent was put in place before the PCNL procedure, as was a Foley catheter for bladder drainage. A gelatin patch sealant was placed in the nephrostomy cortical tract under nephroscopic vision, immediately after the PCNL procedure. Another 15 patients, treated using a standard PCNL with tube drainage post-PCNL, were enrolled as a control group.

Results: The stone burden, mean operative time, and stone-free rate (67% versus 73%, $p = 0.33$) were not statistically different between the 2 groups. In the 15 patients who received tubeless PCNL treatment, there were no severe complications related to the gelatin packing in the nephrostomy tract, and no significant bleeding or urine leakage occurred after the packing. The necessity for blood transfusion was much lower in the tubeless group as compared with the tube-drainage group (6.6% versus 26.7%; 0.2 ± 0.1 units versus 0.9 ± 0.5 units, $p = 0.013$). Tubeless patients began ambulation and were discharged from the hospital earlier (3.4 days versus 5.1 days, $p = 0.035$) than those in the tube-drainage group. Analgesic requirement was significantly less with the gelatin sealant technique when compared with the tube drainage group (85 ± 20 mg versus 185 ± 25 mg, $p = 0.008$).

Conclusion: Gelatin sealant packing is an alternative, available, and feasible method for preventing bleeding and urine leakage postoperatively in selected patients receiving tubeless PCNL. [*J Chin Med Assoc* 2006;69(4):162–165]

Key Words: bleeding, gelatin packing, percutaneous nephrostomy, urine leakage

Introduction

Since its advent in the 1950s, percutaneous renal access has evolved to be the preferred method for treating many urologic conditions.[1] Among techniques using percutaneous renal access, percutaneous nephrostomy (PCN) management of renal stones has been a well-accepted procedure since the 1970s. Various modifications have been made to the PCN technique and equipment in an attempt to decrease the morbidity of the procedure and increase cost-effectiveness, including the tubeless method.[2] Nevertheless, urine leakage and bleeding along the nephrostomy tract after the PCN procedure is still a main concern. Herein is described a gelatin patch sealant method that is designed to achieve hemostasis and hydrostasis after PCN procedures. The results of standard tube drainage and sealant groups are compared.

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Methods

Patient enrollment

Percutaneous nephrostomy lithotripsy (PCNL), using the modified tubeless technique, was performed nonselectively in 11 men and 4 women. Another 15 patients who received traditional PCNL were identified as the control group in this study. The indications for PCNL included a renal stone burden of 2.5 cm or greater in length, or an association with obstruction. The stone burden was calculated from the measurements of the sum of the area of each stone in cm^2.

Modified technique using gelatin sealant packing

In all cases, stones were removed using a direct approach with lithoclast. In our hospital, the PCN catheter usually was inserted by a senior radiologist the day before the PCNL procedure in order to lessen bleeding. On the table, 1 access tract was created, using internal urethrotome on each renal unit along the PCN catheter guide under nephroscopic direct vision with the conjunction passage of a 30–32F working sheath (Figure 1A). After completion of the stone extraction using lithoclast, the nephrostomy tract was packed with a patch of absorbable gelatin sponge (Gelfoam, Pharmacia & Upjohn, Kalamazoo, MI, USA) in proper size (Figure 1B). Then the working sheath was removed, and a drainage tube was left in the retroperitoneal space for 12–24 hours. Patients who were hemodynamically stable, and whose pain was controllable with oral narcotic medications, were discharged the day after PCNL with the retroperitoneal tube having been removed.

Postoperative follow-up and statistical analysis

The medical records of the patients were reviewed with respect to stone burden, operative time, stone-free outcome, length of hospitalization, analgesic requirement, transfusion rate, and complications. Residual stones were not recognized as a complication after PCNL. Another 15 cases of patients treated with PCNL and temporary nephrostomy tube drainage (1–3 days) were enrolled as comparison in the same period. All parameters were analyzed statistically using Mann-Whitney rank sum and Chi-square tests. A p value of 0.05 or less was considered significant.

Results

The average age of the patients was 55.6 years (range 43–67 years) in the standard tube drainage group and 54.5 years (range 41–65 years) in the gelatin sealant group. There was no significant difference in gender and stone site distribution (Table 1). The stone burden was not significantly different between the groups (5.3 ± 2.2 cm^2 versus 4.5 ± 1.6 cm^2, p = 0.36); neither was the mean operative time (67 ± 21 minutes versus 52 ± 16 minutes, p = 0.20). The blood transfusion rate was much lower in the gelatin sealant group when compared with the tube-drainage group (6.6% versus 26.7%, p = 0.0001; 0.2 ± 0.1 units versus 0.9 ± 0.5 units, p = 0.013).

The stone-free rate immediately after PCNL was similar in both groups (67% versus 73%, p = 0.33). Residual stones were all treated with extracorporeal shock wave lithotripsy at the outpatient clinic.

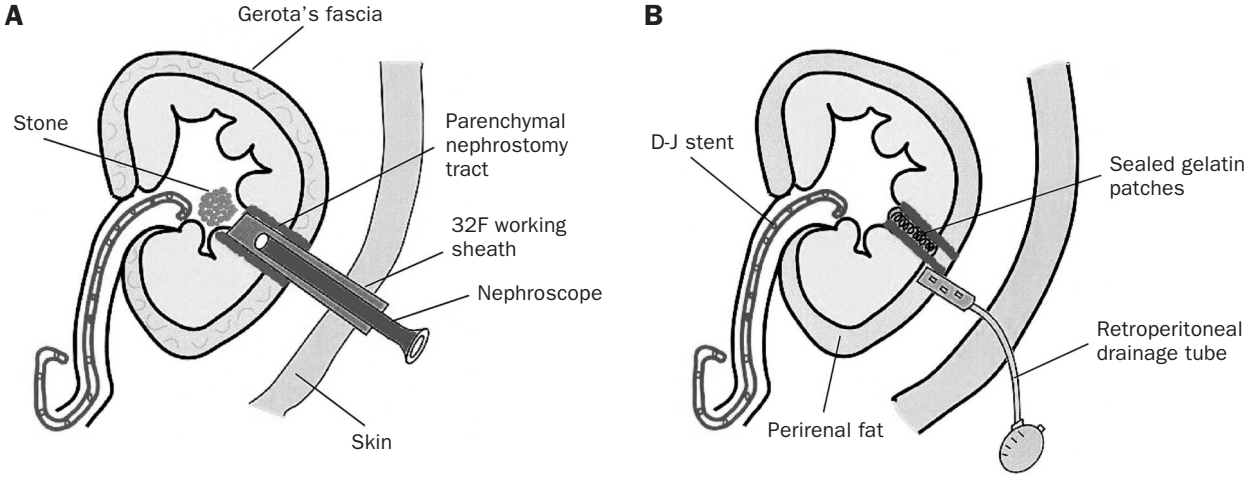

Figure 1. (A) The procedure of percutaneous nephrostomy lithotripsy. (B) Modified tubeless percutaneous nephrostomy lithotripsy with gelatin sealant packing in the parenchymal tract.

The analgesic requirement was significantly less for those patients receiving the gelatin-sealant technique when compared with the tube-drainage group (85 ± 20 mg versus 185 ± 25 mg, $p = 0.008$). The average length of hospitalization was significantly less in the sealant-tubeless group (3.4 days, $p = 0.035$) compared with the tube-drainage group (5.1 days). No severe complications or morbidities occurred in either group.

Discussion

In 1976, Fernstrom and Johansson[1] first introduced removal of a renal calculus via a percutaneous tract. Since then, PCNL has undergone numerous refinements in both instrumentation and technique, including tubeless PCNL and mini-PCNL.[2–4] These modifications were introduced to achieve a reduction in postoperative analgesia requirement, hospital stay and cost, as well as to decrease trauma to the percutaneous tract (Table 2).[2–7] In 1997, Bellman et al[2] challenged the requirement for routine placement of a nephrostomy tube after percutaneous renal surgery, introducing the so-called tubeless method. Their recommendations for the use of tubeless PCNL include a small stone burden of less than 3 cm in diameter, only 1 access, no distal obstruction, no significant bleeding or collecting system perforation during the primary PCNL, and no requirement of secondary PCNL.[8] Nevertheless, low or even less morbidity is a major concern when performing tubeless PCNL in comparison with standard PCNL. Among the possible complications, renal bleeding and urinary leakage are common.

Table 1. Demographics and treatment outcomes in patients who received standard or modified tubeless percutaneous nephrostomy lithotripsy

Parameters	Tube-drainage group (n = 15)	Gelatin-sealant group (n = 15)	p value
Age, yr	55.6 ± 9.5	54.5 ± 12.4	0.78
Sex, M:F	11:4	9:6	0.80
Stone site, Lt:Rt	8:7	7:8	0.45
Stone burden, cm^2	5.3 ± 2.2	4.5 ± 1.6	0.21
Operative time, min	67 ± 21	52 ± 16	0.20
Blood transfusion			
cases, n (%)	4 (26.7)	1 (6.6)	0.0001
units	0.9 ± 0.5	0.2 ± 0.1	0.013
Stone-free rate, n (%)	10 (67)	11 (73)	0.33
Demerol analgesics, mg	185 ± 25	85 ± 20	0.008
Length of stay, d (range)	5.1 ± 2.5 (3–10)	3.4 ± 1.6 (3–5)	0.035
Complications	0	0	

Mean ± SD

Table 2. Comparison of PCNL outcomes in different reports

Year	Author and reference no.	PCNL method	No. of cases	Stone burden, cm^2	Blood transfusion, %	Stone-free rate, %	Hospitalization, d	Complications
1997	Bellman et al[2]	Tubeless	50	–	–	–	0.6	0
1999	Goh and Wolf[5]	Standard	13	3.0	7.6	92	3.6	3 (perforation, leak)
		Tubeless	8	1.8	0	75	2.3	1 (ureteral obstruction)
2000	Monga and Oglevie[3]	Mini-PCN	21	2.8	0	90	1.1	1 (atelectasis)
2001	Feng et al[7]	Standard	10	8.4	10	38	4.1	1 (bleeding)
		Mini-PCN	9	4.9	11	63	3.2	1 (bleeding)
		Tubeless	8	4.4	0	71	1.9	0
2002	Limb and Bellman[6]	Tubeless	86	3.3	6	93	1.3	1 (pseudoaneurysm)
2005	Current series	Standard	15	5.3	26.7	67	5.1	0
		Tubeless with sealant	15	4.5	6.6	73	3.4	0

PCNL = percutaneous nephrostomy lithotripsy; PCN = percutaneous nephrostomy.

Diabetes, multiple-tract procedures, prolonged operative time, and the occurrence of intraoperative complications are associated with significantly increased blood loss during PCNL. Maneuvers that may reduce blood loss and transfusion rate include ultrasound-guided access, use of Amplatz or balloon dilatation systems, reduction in the operative time, and staging the procedure in cases of a large stone burden or intraoperative complications.[9] Bleeding following PCNL can arise from a variety of sources and may occur from the mucosa of the collecting system, renal parenchyma, an arteriovenous fistula or pseudoaneurysm, or the intercostals or subcutaneous vessels.[2] Bellman et al[2] suggested a Kay tamponade balloon for direct pressure to limit intract hemorrhage.

In addition to tamponade balloon, Jou et al[10] have proposed cauterization along the PCNL tract to decrease the possibility of postoperative bleeding in selected patients.

Lee et al[11] have described the use of a commercial gelatin matrix hemostatic sealant as an adjunct to tubeless percutaneous nephrolithotomy to help preclude bleeding complications, and, from their pilot experience, they concluded that it provided immediate and effective hemostasis. However, although commercial gelatin matrix hemostatic sealant is effective, it is expensive. The gelatin sponge can be absorbed within 2 weeks and be replaced by parenchymal tissue. In our preliminary experience of limited cases, this modified technique could achieve both aims, reducing bleeding and leakage after PCNL. The longer hospital stay in our series was because of the 2-stage PCNL procedure with PCN tube insertion on the first day, followed by PCNL the next day, in an attempt to lessen hemorrhage during PCNL.

In conclusion, when performing tubeless PCNL in selected cases with renal stone disease, gelatin sponge sealant is an alternative, applicable, and feasible material for hemostatic and leakage prevention.

Acknowledgments

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